

WHAT IS CLAIMED IS:

1. A cost-estimation method comprising:
extracting an estimation element necessary to
determine a manufacturing process;

5 extracting a cost physical unit value, which
corresponds to the estimation element, from a physical
unit table showing cost physical unit values used in
each step of the manufacturing process;

10 automatically converting an estimation formula,
expressed at least by a four-rule calculation rule,
into a format which can be executed by a preinstalled
programming rule; and

15 substituting the physical unit value in the
estimation formula converted into the format, thereby
obtaining costs of said each step.

2. The cost estimation method according to
claim 1, wherein the step of executing automatic
conversion includes:

20 creating a first source program configured to
extract the estimation element from the estimation
formula, and to convert the estimation element into
a format which can be executed by the preinstalled
programming rule;

25 creating a second source program configured to
extract, from the estimation formula, the estimation
element included in the physical unit table, to convert
the estimation element into the format which can be

executed by the preinstalled programming rule, and to
extract the physical unit value from the physical unit
table;

5 converting the estimation formula into the format
which can be executed by the preinstalled programming
rule, on the basis of the first and second source
programs.

10 3. The cost estimation method according to
claim 1, wherein in the step of executing automatic
conversion, the estimation element is extracted from
the estimation formula by determining an identifier and
a name of the estimation element in the estimation
formula, thereby converting the estimation element into
the format which can be executed by the preinstalled
15 programming rule.

4. The cost estimation method according to
claim 1, wherein the estimation formula contains
a function.

20 5. A cost-estimation apparatus comprising:
an estimation element database which stores an
estimation element necessary to determine a manufactur-
ing process from a three-dimensional product CAD model;
an estimation reference database which stores
a cost physical unit value used in each step of the
25 manufacturing process;

an estimation-element-extracting section which
extracts the estimation element from the estimation

element database;

5 a source-program-creating section configured to create a source program, the source program automatically converting an estimation formula, expressed at least by a four-rule calculation rule, into a format which can be executed by a preinstalled programming rule; and

10 a cost-estimating section configured to obtain costs of said each step by substituting the physical unit value, extracted from a physical unit table, in the estimation formula converted by the source-program-creating section.

15 6. The cost estimation apparatus according to claim 5, wherein the estimation formula contains a function, and the source-program-creating section converts the estimation formula into the format which can be executed by the preinstalled programming rule.

20 7. The cost estimation apparatus according to claim 5, wherein the source-program-creating section includes:

25 a first source-program-creating section which creates a first source program configured to extract the estimation element from the estimation formula, and convert the estimation element into a format which can be executed by the preinstalled programming rule;

a second source-program-creating section which creates a second source program configured to extract,

from the estimation formula, the estimation element included in the physical unit table, to convert the estimation element into the format which can be executed by the preinstalled programming rule, and to
5 extract the physical unit value from the physical unit table; and

a third source-program-creating section which converts, on the basis of the first and second source programs created by the first and second source-
10 program-creating sections, the estimation formula into the format which can be executed by the preinstalled programming rule.

8. The cost estimation apparatus according to claim 5, wherein the source-program-creating section
15 extracts the estimation element is extracted from the estimation formula on the basis of an identifier and a name of the estimation element in the estimation formula.

9. A product-manufacture-estimation method
20 comprising:

extracting an estimation element necessary to determine manufacturing steps;

setting the steps of manufacturing a product on the basis of the estimation element;

25 estimating costs required for each step;

multiplying the estimated costs by a process rate, and adding a material cost to the multiplication

result, thereby calculating a whole cost;

estimating and analyzing a rate-determining factor
on the basis of the estimated costs and whole cost; and

executing a cost simulation by varying the

5 processing step, analyzing a degree of influence upon
the whole cost, and assisting the designing of the
manufacturing steps.

10 10. The cost estimation method according to
claim 9, wherein the step of estimating the costs
includes:

15 creating a first source program configured to
extract the estimation element from the estimation
formula, and to convert the estimation element into
a format which can be executed by a preinstalled
programming rule;

20 creating a second source program configured to
extract, from the estimation formula, the estimation
element included in a physical unit table, to convert
the estimation element into the format which can be
executed by the preinstalled programming rule, and to
extract the physical unit value from the physical unit
table;

25 converting the estimation formula into the format
which can be executed by the preinstalled programming
rule, on the basis of the first and second source
programs.

11. A product-manufacture-estimation apparatus

comprising:

an estimation element database which stores an estimation element necessary to determine a manufacturing process from a three-dimensional product CAD model;

5 an estimation reference database which stores a cost physical unit value used in each step of the manufacturing process, and an estimation formula expressed at least by a four-rule calculation rule;

10 a process setup reference database which prestores reference data for process setup;

a process-rate/material-cost database which prestores a material unit price, a purchase unit price and a process rate;

15 an estimation-element-extracting section which extracts the estimation element from the estimation element database;

20 a process setup section which searches the process setup reference database on the basis of the estimation element extracted by the estimation-element-extracting section, thereby setting the manufacturing process;

a source-program-creating section configured to create a source program, the source program automatically converting the estimation formula, stored in the estimation element reference database, into a format which can be executed by a preinstalled programming rule;

a cost-estimating section configured to obtain

costs of said each step set in the process setup
section by substituting the physical unit value
extracted from a physical unit table, in the estimation
formula converted by the source-program-creating
5 section;

a cost estimating section which multiplies the
costs estimated by the cost-estimating section, by the
process rate stored in the process-rate/material-cost
database, and adds a material cost, based on the
10 material unit price, to the multiplication result,
thereby calculating a whole cost;

a cost analyzing section which estimates and
analyzes a rate-determining factor on the basis of the
costs estimated by the cost-estimating section, and the
15 whole cost calculated by the cost estimating section;
and

a cost simulation section which executes a cost
simulation by varying the processing step, analyzing a
degree of influence upon the whole cost, and assisting
20 the designing of the manufacturing process.

12. The product-manufacturing estimation apparatus
according to claim 11, wherein the source-program-
creating section includes:

a first source-program-creating section which
25 creates a first source program configured to extract
the estimation element from the estimation formula, and
to convert the estimation element into a format which

can be executed by the preinstalled programming rule;

a second source-program-creating section which creates a second source program configured to extract, from the estimation formula, the estimation element included in the physical unit table, to convert the estimation element into the format which can be executed by the preinstalled programming rule, and to extract the physical unit value from the physical unit table; and

a third source-program-creating section which converts, on the basis of the first and second source programs created by the first and second source-program-creating sections, the estimation formula into the format which can be executed by the preinstalled programming rule.

13. The product-manufacturing estimation apparatus according to claim 11, wherein the estimation-element-extracting section supplements another estimation element in accordance with an input operation of an operator, if the estimation element extracted from the three-dimensional CAD model is insufficient to specify the manufacturing process.

14. The product-manufacturing estimation apparatus according to claim 11, further comprising a three-dimensional CAD which creates the three-dimensional CAD model, and wherein the cost analyzing section provides the three-dimensional CAD with a factor that inhibits

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